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GROWING POTATOES FOR SEED PURPOSES

Karl H. Fernow

Persons who have never grown certified potatoes are sometimes misled by the relatively high prices charged for such seed into thinking that the growing of certified seed is an easy way to make money. Any one who is acquainted with the certified seed business knows that this is not the case.

From the standpoint of the buyer the justification for high prices paid lies in the fact that 11,627 tests conducted in twenty-seven states and eight provinces showed an average increase in yield from the use of certified seed of 46 bushels an acre and that the crop produced was of better quality.¹

From the standpoint of the producer the price is justified by the extra expense of inspection and certification, the extra labor of seed selection, roguing and sorting, the increase in the percentage of the culls and insurance against failure of the crop to qualify after the expenses have been incurred. If these factors are all given proper consideration it is probable that certified seed production does not give an excessive return to the grower. On the other hand it is probable that the growing of certified seed has stimulated many growers to take better care of their own seed and use better cultural methods thus increasing their efficiency in potato production.

Certified seed growers must realize that there has been a great improvement of late years in the general quality of uncertified seed. There is a large amount of uncertified seed on the market which can give as good an account of itself as the average certified seed. As this seed can be sold at a lower price it may naturally be ex-

(1) Moore, H. C. Evidence that certified seed is improved seed. Proc. of 11th Ann. Meeting, Potato Assoc. of America, 1924: 26-40. 1925.

pected to furnish serious competition to certified seed. The only objection to its use is that when one buys it one cannot be sure of getting high quality seed. Unless the certified growers can produce a product that is practically certain to be of very high quality they cannot hope to compete with this cheaper uncertified seed.

For these reasons no person should engage in the growing of certified seed unless he is willing to take great pains in improving and maintaining the quality of his stock. The location of a farm may have an influence on the quality of seed produced. For example, it is well known that seed grown on Long Island degenerates rapidly due to the accumulation of virus diseases while it is reported that the disease in seed taken to certain parts of Canada tends to eliminate itself. At present we do not know enough about such factors to make definite recommendations but it appears that, in general, cool regions which are hilly, have a high elevation and where potato fields are far apart, produce better seed than warmer sections which are level, lower and where potato fields are close together.

The practices recommended below will be found helpful in growing good seed although it must be noted that some men who have paid little attention to them have grown good seed while complete adherence to them will not necessarily insure success.

GROWING THE CROP

To produce good certified seed profitably it is necessary to start with the best stock available. It is doubtful whether it will pay the grower to try to have fields certified which contain more than 4 per cent leaf roll or spindle tuber or 7 per cent mosaic. It is almost certain that such seed if certified will disappoint the buyer and thus injure the market. The seed should also be of a high yielding strain. In the past too little attention has been given to this last factor.

The field should be isolated as far as possible especially from potatoes likely to be diseased. Virus diseases spread from field to field and fences will not keep them out.

As mentioned above it will not pay to remove large numbers of diseased plants in order to meet the requirements of certification. Where the amounts of disease are excessive it would be advisable to withdraw the field and start with a new strain the following year.

Roguing should be done as early as possible. In an experiment performed in Canada (2) two years of roguing in July reduced the amount of leafroll from 10 per cent the first year to none the third year while roguing in August and September permitted leaf roll to increase from 10 per cent the first year to 44 per cent the third

(2) MacCurry, J. B. Report of the Dominion field laboratory of plant pathology, Charlottetown, P. E. I. Rept. Dominion Botanist 1922: 23-32. 1923.

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year. When the plants are still small roguing can be done quite rapidly. It may be necessary to rogue a second or even a third time after the vines are larger but at this time diseased plants will be more easily overlooked and it will take longer to remove them. An in the meantime if insects have come into the field the diseases will have been spreading. The exact time to make the first roguing will vary with conditions but will usually be about 6 to 8 weeks after planting.

Another reason for roguing early is that it has been shown that the symptoms of mosaic tend to disappear above 68°, so that later on it may become almost impossible to detect this disease. Spindle tuber on the other hand shows more clearly when the temperature has been high (3). Roguing will be found to be most satisfactory in the early morning or on a cloudy day since when the sun shines directly on the plants mosaic is very difficult to detect.

All plants showing mosaic, leaf roll, spindle tuber and yellow dwarf and all weak plants together with the seed pieces and new tubers if any should be removed from the field. By weak plants are meant plants suspected of being affected with a virus disease. Plants weak because of the attack of rhizoctonia or rotting of the seed piece are not necessarily injurious to the seed crop but should be removed if there is danger of their being confused with leaf roll plants.

The field should be thoroughly sprayed using at least 200 pounds pressure and at least two nozzles per row. Dust may be used if preferred although to date it has not proved as satisfactory as spray especially for the control of flea beetles and leaf hoppers. The use of nicotine sulphate in the spray for the control of aphids and leaf hoppers has not proved altogether satisfactory. It is possible that dust will be found a more effective carrier for nicotine. At present we cannot recommend the use of nicotine on the field on account of its high cost and relative inefficiency.

Digging should not be started ordinarily before the vines are dead because of loss in yield and injury to the tubers. Tubers dug when the vines are green present a poor appearance and shrink more in storage than those dug when the tuber is mature.

If late blight is present in the field, digging should be delayed for 10 days after complete death of the vines. Otherwise the spores of the late blight fungus, which are present on the tops and in the soil, may come in contact with the tubers while being dug and produce infection which will not show until after the crop is placed in storage.

Great care should be used in harvesting the crop to prevent injury to the tubers. Small cuts and bruises, besides injuring the

(3) Goss, R. W. & Peltier, G. L. Further studies on the effect of environment on potato degeneration diseases. *Nebr. Agr. Exp. Sta. Research Bul.* 29: 1-32, Pls. 7. 1925.

appearance of the stock, provide places where rot organisms can gain entrance. It is, of course, impossible to completely eliminate injury at digging time but much may be done by running the digger deep, using sections of rubber hose on kickers and exercising care in picking and grading the crop.

At digging time the grower should carefully note any sections of the field in which scab is severe and drive stakes at the edge of the field that will enable him to locate these spots the next time potatoes are planted in this field. Scab can be prevented by the use of sulfur. If sulfur is applied it should be used with care and only on sections of the field which produce severe scab.

Yield. The above outlined program probably represents an increased investment in the crop of \$50 to \$100 per acre. On this basis the grower cannot afford to have a poor yield. If he is to make a profit he must use good land and enough fertilizer and cultural care to protect his investment in seed and spraying. In other words a man who might be satisfied to get a yield of 125 to 150 bushels per acre of market stock without spraying or use of improved seed should get from 200 to 300 bushels if he is to grow seed stock. He will also find that high yields have considerable advertising value in the seed market although there is no scientific justification for this.

Growing the Seed Plot

It is not worth while to try to improve badly diseased stock. The grower should start with the best seed obtainable. If after the work has been started, it is found that more than 10 per cent to 12 per cent disease is present it would probably be better to start over the following year with better stock. The seed plot should be conveniently located, should be as nearly square as practicable. It should on no account be planted in the neighborhood of potato fields containing large amounts of disease but may be planted at one end or side of the main field if the seed used for the field is practically as good as that used for the seed plot. It is inadvisable to have potatoes of different varieties adjoining one another because it has been shown that in some cases diseases which are injurious to one variety may be present in another without producing visible symptoms. Before planting, the tubers should be disinfected to insure a good stand.

The potatoes should be planted by the tuber unit method. According to this method tubers of 8 to 10 ounces are used. These are cut in 4 pieces and the 4 pieces planted in 4 consecutive hills. Any one of the three planting systems indicated below may be

The requirements for grading vary in different states. Certified seed ought to be graded to have a good appearance, at least as good as U. S. No. 1 and preferably better.

used. The four similar letters represent 4 hills from the same tuber in each case:

A B C D E F G H —	A A B B C C D —
A B C D E F G H —	A A B B C C D —
A B C D E F G H —	H H I I J J K —
A B C D E F G H —	H H I I J J K —
	AAAA SSSS CCCC DDDD —
	GGGG HHHH IIII JJJJ —
	MMMM NNNN OOOO PPPP—

If the seed plot adjoins other potatoes at least 4 extra rows of tuber units should be planted to serve as a buffer to prevent diseases in the adjoining field from spreading into the seed plot.

Recent experiments in Nebraska have shown that spindle tuber may be carried from one tuber to another on the cutting knife. This possibility may be provided against by using several knives in rotation and placing them in formalin solution when not in use. Since good results have been secured in the past without use of this precaution and since it adds greatly to the labor of planting we do not recommend it except for growers who wish to take every precaution.

If planting is done by hand, as will usually be the case, care should be taken to plant only in freshly opened furrows and to cover the seed as soon as possible. Neglect of these precautions is the most common cause of poor stands in seed plots and a poor stand detracts enormously from the value of the seed plot.

It is in roguing that the tuber unit method is of especial value. Where diseased plants occur in groups of four, roguing can be done faster, earlier and much more thoroughly. This is especially so in the case of diseases difficult to detect and when the person doing the roguing has had little experience. If the roguer compares each unit with those surrounding it and removes every unit which appears abnormal he can be sure of removing practically every diseased plant in the plot. Roguing should be begun early and repeated at least twice at intervals of about two weeks. It will be found that roguing can be done much more rapidly than in the main field and the grower should remember that every diseased plant removed in the seed plot means from five to twenty fewer to remove the following year in the field.

Sometimes units appear mixed; that is one or more plants appear healthy while the rest show mosaic, leaf roll, or spindle tuber. This apparently results from plants becoming infected late the previous season so that the virus does not have time to spread throughout the tuber before growth ceases. Data as to the frequency with which this may be expected to occur are furnished by experiments performed in Maine. Of 6148 units planted with seed

from healthy fields which were next to diseased fields, 1016 showed disease, or 16.5 per cent. Only 61 of these units were mixed, or 1 per cent of the total and 6 per cent of the units showing disease. Even fewer mixed units occurred when the seed used came from diseased fields. In this case there were 1520 units of which 815 were diseased, or 54 per cent. Of these, 4 units were mixed or 0.26 per cent of the total or 0.5 per cent of the diseased units. The frequency of mixed units is therefore not great enough on the average to seriously interfere with the success of the tuber unit method of roguing. No doubt mixed units will occur more frequently in some stocks and in certain years.

If the grower feels that he cannot spend more time on the plot it may be dug with a machine. In this case a seed plot of the same type should be planted the following year. It is, however, strongly recommended that the grower make an effort to dig at least part of the plot by hand and select units for further testing. If this is done the grower should dig at least 100 units and select from these at least 30 of the best yielding units. Each unit saved should be stored in such a way as to keep it separate. Paper bags are commonly used although these are not entirely satisfactory. Small baskets with covers, cheese boxes or other wooden containers might be preferable. Burlap bags may be used by tying in the middle.

In planting the second year only potatoes 6 ounces or more are used and only a definite number from each unit. Let us assume that it is found possible to plant 10 tubers from each unit. The planting plan for these will be as given below:

(Line A) 1111 2222 3333 4444 5555 (Line N) 1111 2222 3333 4444 5555
(Line B) 1111 2222 3333 4444 5555 (Line O) 1111 2222 3333 4444 5555
(Line C) 1111 2222 3333 4444 5555 (Line P) 1111 2222 3333 4444 5555
etc.

(Line M)	1111	2222	3333	4444	5555	(Line Z)	1111	2222	3333	4444	5555
(Line A)	6666	7777	8888	9999	0000	(Line N)	6666	7777	8888	9999	0000
(Line B)	6666	7777	8888	9999	0000	(Line O)	6666	7777	8888	9999	0000
(Line C)	6666	7777	8888	9999	0000	(Line P)	6666	7777	8888	9999	0000
				etc.							

(Line M) 6666 7777 8888 9999 0000 (Line Z) 6666 7777 8888 9999 0000

The product of each tuber unit of the year before constitutes what is known as a tuber line. The tuber lines are here represented by the letters A, B, C, etc. The individual tubers are represented by the numbers 1, 2, 3, etc., four hills being planted from each tuber. It will be noted that the tuber units of each line are planted in two different places. This is known as replication and



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is for the purpose of reducing the error due to differences in the soil, distribution of fertilizer, etc. If the tuber units do not all produce ten six ounce tubers it will be impossible to replicate until the third year. When this plot is dug the higher yielding tuber lines are saved. In comparing the yields use the total yield of the two replications of each tuber line. At least 10 of the highest yielding tuber lines should be saved for testing the following year. Each of these is stored in a bag or other suitable receptacle.

The third year the planting plan is similar to that used the second year except that each tuber line is replicated four times and the rows can be made longer, making it possible to use a digger in harvesting the seed plot. The third year at least three of the highest yielding tuber lines should be saved for increase. It is desirable to make a fourth year's test if possible. The number of units and tuber lines mentioned for test each year should be regarded as a minimum. Better results may be expected if larger numbers are used. It is believed that such a system of seed selection will accomplish more in three or four years than can be accomplished by mass hill selection in twenty years.

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CROP AND MARKET NEWS

POTATO CROP MODERATE BUT PRICES LOW

(Contribution from the Fruit and Vegetable Division, Bureau of Agricultural Economics, U. S. Department of Agriculture)

Warnings by agricultural authorities against excessive planting of potatoes this year seem to have been effective. Estimated plantings throughout the United States aggregate 3,202,000 acres, or only about 2 per cent more than in 1925. Most of the increase is in the West.

The August crop report still indicates moderate production this season. During July, the crop improved in the East and in the North Central region as far as Minnesota. From the Dakotas and Nebraska westward there was a general decline, except in Colorado. Maine now expects practically as many potatoes as last season, or slightly over 34,000,000 bushels. Compared with last year, considerably heavier crops are indicated for New York, Michigan, Wisconsin, Idaho, Washington and Oregon. Minnesota and other important states may not have quite so many potatoes as in 1925, but final production depends largely on weather conditions between now and digging time.

The August estimate was increased about 12,000,000 bushels over the July figure, and the prospective total of 345,569,000 bushels is approximately 20,000,000 more than the short crop of 1925 but 80,000,000 less than the very heavy production of 1924. The indicated crop still lacks 51,000,000 bushels of equaling the average for the last five years. Figuring the population of the United States at 117,136,000, August estimates average 2.95 bushels per capita, which is below normal requirements.

Of the 20,000,000 bushel increase over last year, nearly two-thirds belong to the early and intermediate states or those sections whose carlot shipments are fairly well completed by September 1. Only the remaining third of the increase can be credited to the surplus-producing late-potato states, where the bulk of the carlot supply originates. Actual figures by groups are given below, and detailed data by states can be obtained from the U. S. Department of Agriculture.

Estimate	13 early potato States	16 deficient- producing late-potato States *	19 surplus- producing late-potato States
	bushels	bushels	bushels
August, 1926	27,356,000	75,339,000	242,874,000
Harvested, 1925	22,285,000	68,378,000	235,239,000
Increase this year	5,071,000	6,961,000	7,635,000

* including intermediate States through shipping by September.

Exceptionally heavy arrivals of potatoes during early July had a depressing effect on the market, and prices did not begin to recover until about July 25. During the month prior to that date, declines in New York City averaged almost 75 cents a week. Supplies later began to clean up and an advance of \$1.00 per barrel occurred in New York during the week ended July 31, making the closing price on best Virginia Cobblers \$3.75-\$4.00. But the recovery was only temporary, and by August 7 sales were again being made at \$3.25-\$3.50.

Price lines for this season and last year crossed during late June, and ever since that time potatoes have been selling considerably lower than a year ago. Average weekly shipments between June 20 and August 7 were around 4,700 cars, as against 3,800 during the same period in 1925. As carlot supplies have been nearly one-third heavier, so prices to jobbers have averaged about one-third lower, the level during July, 1925, being around \$5.25 a barrel, and this July around \$3.50 in New York City.

Values were tending downward during early August. The opening week registered declines of 25 cents to \$1.50 per barrel and 15 cents to 50 cents per 100 pounds on sacked stock in the important markets. Cincinnati still held top of \$4.75 on Virginia Cobblers, but most sales ranged between \$3.00 and \$4.50. Lowest quotation

of the week August 2-7 was \$2.75 in Baltimore. Maryland stock was quoted generally on the eastern markets at \$3.00-\$3.50. Long Island Cobblers, some small, sold at \$3.50-\$3.75 in New York. Nearly all the eastern cities reported sales of New Jersey potatoes at \$2.00-\$2.65 per 100 pounds. Prices on sacked Kansas and Missouri potatoes were shaded 25 cents on the Chicago carlot market, with sales on August 7 at \$1.50-\$1.75. California Burbanks brought \$3.00 in Dallas and Fort Worth, on a carlot basis. These two cities quoted Idaho and Utah Cobblers and Rurals at \$2.60-\$2.75 per 100 pounds. All these quotations are considerably below the prices of a year ago. F. o. b. reports from central and southern New Jersey showed most sales at \$2.00-\$2.25 per 100 pounds. Growers in the Kaw Valley of Kansas were curtailing digging on account of the bad condition of markets. Early August quotations from that section were \$1.40-\$1.55 on a cash-to-growers basis.

Shipments were becoming more equalized; a total of 3,200 cars during the first week of August compared favorably with the 3,330 cars shipped during the corresponding period last season. New Jersey showed the largest output, sending 720 cars to market; Kansas was next with 655, and Virginia's movement totaled 340. States shipping from 100 to 300 cars each were Maryland, the Long Island section of New York, Missouri, Colorado, Utah, Idaho, Washington and California. Movement was getting well under way in Kentucky and Minnesota, but these States and most of the other mid-summer sources had not begun to equal last year's record for heavy early shipments. Minnesota, for example, had marketed 1,200 cars to August 8, 1925, compared with less than 100 to the same time this season.

California.—The Los Angeles crop performed very much according to predictions. The average yield in Southern California this year was between forty and fifty sacks of potatoes per acre, which is, of course, a terrible showing and a very heavy financial loss to the farmers in that district. Probably because of the same condition that made the light yields, the quality was very poor and practically none of this crop was exported out of the state, all being used at home and bringing very low prices.

The demand for fancy potatoes in Southern California during the period of time when the local Los Angeles crop usually takes care of it was supplied by potatoes from the Stockton district. These potatoes started to go into Los Angeles as early this year as July 1st.

The digging in the Stockton district started much earlier this year than normally and a much greater quantity has been produced up to August 1st this year than in past years. The harvesting that has been done in the Stockton district shows that on the early potatoes the hills are just about the same as last year, averaging in unfertilized fields about ninety sacks per acre and considerably heavier in fertilized fields.

The general concensus of opinion as to acreage in the Stockton district is about 21,000 acres. It is estimated that up to August 1st between seven and eight thousand acres have been dug.

The general quality of unfertilized fields is of only fair quality. Fertilized fields show a much higher grade and a much better potato.—H. G. Zuckerman, July 26.

SEED CERTIFICATION IN BRITISH COLUMBIA

The industry in this province continues to show steady growth. At present the applications for inspection show an increase of approximately 60 acres, over last year's acreage.

The field inspection standards have been raised this year to eliminate all fields with more than 5 per cent misses. The field inspectors met at the beginning of the season at the University of British Columbia, where they were trained to recognize diseases and varietal characteristics. Another object of this training was to get, as far as possible, a uniform inspection throughout the province. On account of the various soil and climatic conditions prevailing in different districts it has been very difficult to accomplish this in the past and consequently considerable responsibility has rested on the local inspector.

Experiments carried on last year by Mr. G. M. Straight, superintendent of the Dominion Experimental Farm at Sidney, have shown that the results of "virus disease" in the province is as detrimental as in other parts of the country. This year the Provincial Department of Agriculture is carrying on an extensive experiment, co-operating with the Dominion Experimental Farm at Agassiz. Mr. J. E. Eastham, Provincial Plant Pathologist is directing the experiment and it is hoped that much information will be gained which will be of a definite nature.—S. S. Phillips.

Kansas.—Kaw Valley crop is only fair. The valley is very spotted, some districts averaging 100 bushels while other districts are running above 200 with a few fields making 300 to 350. The quality of the crop is excellent, the stock is smooth, free from scab, and uniform. Several growers have been able to pass U. S. Grade without grading. Most growers are putting their stock up in better shape than ever before. There are however, quite a number who are putting up a poor grade and it has had a depressing influence on our market. Many of the growers are talking about a compulsory grading law. It is interesting to note that many who have not graded are in favor of it. They state that the reason they have not graded is that buyers have not been willing to make enough difference in price between well graded stock and ungraded stock. This situation is true in two or three districts in the valley.

The season is late and digging is not over one-third completed. Prices started at \$2.25 per hundred and have continually worked to lower levels. U. S. No. 1 is now selling for \$1.35 f. o. b. while the

market for ungraded stock is demoralized and prices are ranging from 90 cents to 1.05 per hundred.

U. S. Inspectors are busy and several days could not make all the inspections requested. Mr. A. S. Mason is supervising inspector in charge. Inspections are made under a cooperative agreement with the Extension Service of the Kansas State Agricultural College.—**E. A. Stokdyk, July 24.**

Maine.—Potatoes have made a wonderful growth since I arrived here on the 21st of July. It now looks as if the crop would be an average one. The weather has been warmer the past week than usual. Rain is needed in some sections while in others there is sufficient moisture.—**W. Stuart, July 30.**

Michigan.—Recent rains that have been quite general throughout Michigan have helped the potato crop materially. In some of the light soil areas the potatoes were suffering from dry weather. A recent survey over the Lower Peninsula of Michigan shows comparatively good stands and with little injury from the Colorado potato beetle, leaf hopper or other pests. There are, however, an abundance of leaf hoppers in early fields and it is believed that their injury will be apparent later in the season in all fields that are not sprayed with Bordeaux mixture.

In the southeastern counties in the early potato district many fields show heavy infestation of aphids. Many growers are controlling these insects with Nicotine Sulphate added to the Bordeaux mixture. In Genesee, Oakland and a few other southern counties considerable impetus has been given the potato work this season by the Kiwanis Clubs and other organizations. These clubs have donated several hundred bushels of certified seed to members of Boys and Girls potato clubs. Considerable follow up work during the season is done by members of the Kiwanis Club in visiting the various plots and encouraging the club members to use the best methods of culture and to select the seed potatoes carefully. The potatoes are given to the boys with the understanding that they will in turn give a bushel of their seed to some boy who is not now planting certified seed. This type of work has materially bettered the potato crop of the counties where it has been conducted, not only in bettering yields, but also in improving the market quality of the potatoes. Recently 150 boys attended a field meeting in Oakland county where potato diseases were identified and demonstrations were given in roguing, spraying, etc.

The estimated potato acreage in Michigan for 1926 is 249,000 compared with 237,000 for 1925 and 302,000 for the five-year average. On July 1st the condition of the crop was estimated at 86 per cent. This is about 3 per cent higher than it was July 1, 1925, but somewhat lower than the five-year average. The estimated production for 1926 is placed at 26,768,000 bushels which is approximately 2,000,000 bushels more than in 1925 and 5,000,000 lighter than the average production for the past five seasons.—**H. C. Moore, July 30.**

SPECIAL TRAIN OF MISSOURI POTATOES TO CHICAGO

A special train of Missouri Potatoes graded to meet the requirements of the U. S. No. 1 grade, will move from points in Jackson and Ray Counties, known as the Orrick District, to Chicago over the Santa Fe next week according to plans made today. Friday, July 16th has been set for starting the train which will consist of from 30 to 40 cars to be picked up at Atherton, Floyd, Camden, and Henrietta in the afternoon with meetings of growers to be addressed briefly at each point by representatives of the Missouri College of Agriculture and others. The purpose of this train is to demonstrate the quality of the Missouri product by having the entire train loaded with potatoes inspected and passed as U. S. number one grade. Each car will carry a Federal-State Certificate as to the grade, issued by a licensed inspector under supervision of the Missouri State Marketing Bureau. Mr. Bert Offutt of Orrick, an extensive shipper will handle most of the selling.

About four thousand acres of potatoes are normally grown in the Orrick district which includes the Missouri River Bottom land of Jackson, Clay, and Ray Counties. Potatoes from the district have been much improved in quality in recent years due to the use of improved seed of the Irish Cobbler variety and the treatment of seed potatoes before planting to prevent disease, followed by more careful grading of the crop. Growers and representatives of the Missouri College of Agriculture believe that the extent of this improvement is not fully appreciated by the trade and have therefore planned this striking demonstration of quality by shipping at one time an entire trainload of potatoes meeting requirements of the highest market grade as established by the U. S. Department of Agriculture.

The crop in the Missouri district this year is somewhat less than normal owing to a slight reduction in acreage and to early dry weather, but the quality is excellent. The first cars were shipped on July 5th and brought a good price on the Chicago market.

In studying the methods of improving the Missouri potato crop it was found that the Irish Cobbler variety gave better yields, was of excellent quality and was more free from second growth and growth cracks, than the Early Ohio formerly grown, and today about 95 per cent of the crop is Irish Cobbler. Northern grown seed is used and now much of the crop is planted from certified seed.

The treatment of seed potatoes to prevent scab, *Rhizoctonia* and other diseases carried on the surface of seed potatoes has been made practical by the development of the hot formaldehyde method and there are now seven large central or community outfits, two of them power driven, which disinfect a large part of the seed potatoes planted. One of the plants has treated over 60 carloads of seed in the past two seasons.

Better soil management by the frequent use of legumes turned under as green manure and commercial fertilizer have helped to

increase yields and reduce the cost of production per bushel.

The special train is considered a fitting climax to this program of improvement made by a progressive group of Missouri farmers and potato growers.—**E. M. Page, July 15.**

Montana.—Certification acreages in Montana has increased materially the present year. The increase has been in the way of small acreages in the hands of a number of growers. New growers in Montana are compelled to start with a small acreage. Certification applications will not be accepted for large acreages for the grower's first attempt.

The first inspection has just been completed. The heaviest mortality fell on new growers, and especially on those who wanted to start out using their own seed of which nothing was known. Our station check plots, as well as inspection of the growers' own fields quickly eliminated many such fields.

Potato stands are not as good in Montana this year as last. This also applies to commercial plantings. Some sections were caught by hot dry conditions following planting, with resultant poor stands; in other sections the planting was caught by a long, cold, wet spell and much seed rotted in the ground. Late plantings this year have in many sections given by far the best results. The best stands have been obtained by using the whole tuber of two to three ounce size. The large seed piece has also this season given very markedly better germination than has the smaller seed piece.

The percentage of diseases showing on certified stocks with which we have worked for several years is very low. Outside of some poor stands, Montana stock is looking exceptionally well.

Professor Tiebout and a party from Louisiana will spend the period from August 9 to August 20 looking over certified seed stock in Montana. He will be accompanied by growers and county agents from Louisiana who are interested in seed stock.—**F. M. Harrington, July 30.**

Nebraska.—The first field inspection of fields entered for certification has been completed and second inspection is well under way. There have been some rejections due to mosaic and spindle-tuber, but the amount of excess disease in these fields is smaller than in former years, thus indicating a general rather pronounced improvement in the seed stocks. According to present prospects there should be a slightly greater production of certified seed in Nebraska than there was last year, depending on weather conditions.

In the course of our inspection we have noted what seems to be very conclusive evidence that flea beetles have spread both mosaic and spindle-tuber to a very serious extent. The percentage of disease having increased from less than 3 per cent in this lot last year to over 12 per cent this year. Flea beetles were the only insects present in large numbers in the seed field last year. There also was some evidence that spindle-tuber was transmitted by "picker planters."—**H. O. Werner, July 31.**

New Brunswick.—A little less than the average acreage was planted this spring, and probably farmers are less interested than usual on producing certified seed following their last year's experience in marketing seed potatoes for table use. The acreage entered for inspection does not exceed 2000 acres of the Irish Cobbler, and the Green Mountain varieties. The first inspection will be completed at the end of July. The reports thus far indicate that mosaic disease is quite prevalent. Our spring opened very late, but the crop growing conditions were very favorable during July. Many of our growers are practicing early spraying and dusting.—O. C. Hicks, July 30.

New Jersey.—On account of the very hot weather and low prices very few potatoes have been harvested in central New Jersey. On August 2, however, most of the dealers plan to start loading and the shipments during August will be heavy. The yield is good and the quality of the crop excellent. Several of the largest dealers have made arrangement for shipping point inspection so that this year's crop promises to be the best shipped out of New Jersey for some years.

The growers of late crop potatoes are now planting their crop. The seed came out of cold storage in good condition and most of it is being treated. One group of growers disinfected 1500 bushels in hot formaldehyde on the Del-Bay Farm at Bridgeton. The applications for certification are not due until Aug. 25 but the indications are that the acreage this year will be about the same as last. A number of seed growers have already sold out their entire crop.—Wm. H. Martin, July 29.

Ontario.—The planting of potatoes for the early table market was two weeks late, owing to backward weather, conditions since have been favourable for a healthy growth.

There is a much better set of tubers this season on the Cobblers compared with last year, and good yields are now being harvested. Prices for new earlies average around \$1.75 to \$2.00 per bushel at this date and appear to be holding firm.

The acreage planted to potatoes in Ontario this year is estimated at 159,000 compared with 163,790 for 1925. Heavy rains have been of frequent occurrence and some reports have been received of seed rotting in the ground. Blackleg is rather more prevalent than usual in the seed brought in from outside points but the extent of these losses will not be very great.

Later plantings for seed and main crop are making excellent growth at this time and present prospects are for a better yield than in 1925.

Fewer applications for field inspection, for certification, have been received this season, apparently due to the fact that table stock prices were high last season and there was not enough spread between prices obtained for table stock and certified seed. A higher standard for certification has come into effect this season, this also has discouraged some growers.

Approximately 355 fields (850 acres) are entered for inspection, against 1270 acres in 1925. Irish Cobblers, Green Mountains and Dooleys are now the only varieties entered. The bulk of the inspections are for the Irish Cobbler variety.

The Dooley (Rural New Yorker No. 2 type) is a variety that has given excellent results in many parts of this Province and the acreage planted to this variety has increased materially this season.

—J. Tucker, District Inspector, Ontario, Aug. 4.

Oregon.—Oregon last year shipped nearly 2,000 cars of potatoes. The acreage is slightly larger this year, but the condition is now slightly poorer and indications are that shipments will show very little, if any, increase. Hot weather in May and June at the time of planting of late potatoes caused poorer stands this season. Late frosts in the high mountain valleys of Eastern Oregon delayed the crop there and unless they have an unusually late season the potatoes will run heavily to small sizes. Dry weather in Western Oregon caused premature ripening and will result in small potatoes.

There is a heavy planting of back yard acreages, both on farms and in the cities. These potatoes will go on the local markets, which will therefore be better supplied than ordinarily.

We will have more and better certified seed than in previous years. There is more interest this year, and more good seed was available for planting. Different groups of growers are using different methods for seed improvement. We now have several lots of high class seed developed by the greenhouse index method, and others of our growers have seed they have developed by the hill unit method. In this latter group the grower's entire crop will consist of the progeny of a single outstanding hill produced several years ago.—E. R. Jackman.

SEED POTATO ACREAGE UNDER INSPECTION IN PRINCE EDWARD ISLAND FOR 1926

The acreage under inspection this year will be an increase over that of 1925 which was reduced from the highest acreage we have inspected since the work began. This increase is, no doubt, due to the high prices which prevailed for both seed and table stock this past season. In so far as this section is concerned, the grower who has been in the seed producing business is not increasing his area to any extent but we have a large number of new growers who have entered their fields for inspection. These men have been growing common stock and now find that the varieties they have been growing (McIntyre and Dakota Red) are not now in such demand in certain markets as heretofore, whereas, in the case of Cobblers and Mountains, should they pass inspection and the seed price is good, the growers gain that much. The table given below shows at a glance the acreages under inspection here since 1920.

Potato Acreages Inspected in Prince Edward Island

Year	Acreage	Percent Passed
1920	886	59.0
1921	963	56.2
1922	2367	90.6
1923	3213	94.9
1924	9003	88.2
1925	7330	88.6
1926	8000 (estimated)	

The reason such a low per cent passed in 1920 and 1921 is due to the fact that at that time we were inspecting anything and everything requested by the growers including common stock of varieties for which there was no demand for seed purposes. In 1922 these were all eliminated from our lists and only those actually entered for seed purposes included.

The seed used this year was up to the usual good quality in most cases. Owing to good prices prevailing for table stock it was at first thought more No. 2 stock might be used but with the decrease in prices as the season advanced considerable No. 1 stock was left over for planting. Seed treatment with cold bi-chloride of mercury 1-1000 was the general practice. The soil worked up well after a winter of unusually heavy snowfall. Home mixed chemical fertilizer was used, some being broadcasted before planting, some only broadcasting the acid phosphate and then supplying the ammonia and potash on the drill a week or so after planting. Very little rotting of sets has been reported. Weather conditions have been ideal for rapid germination and growth. Flea beetles and Colorado beetles are reported as being particularly numerous and active. We anticipate making a start on first inspection about July 26th. This has been our average date for some years past. The season here, as elsewhere, is somewhat later than usual but the vine growth is very rapid and the time to make two inspections so short that we cannot afford to lose any time early in the season which it would be impossible to pick up later on.

The crop prospects at the present time look very promising although it is too early as yet to make any definite statement.—**S. G. Peppin, District Inspector, P. E. Island.**

Washington.—The potato situation in Washington is a peculiar one this year. In the first place the cold rains in May caused the seed pieces to rot in the ground. The only good stand of May planted potatoes in western Washington is where whole seed was used. There are some very poor stands in parts of Yakima Valley, especially where poor seed was used. I found places in Walla Walla County where two or three hot days in early July had "cooked" the leaves, the leaves were killed as if a match had been held under them. At the same time certain western Washington potato fields in Thurston County were nipped with frost and corn was killed (July 16).

Hot days in late July have caused a masking of mild mosaic symptoms even in large areas in western Washington. Inspection for virus diseases is extremely difficult this year due to the masking of the symptoms.—Geo. L. Zundel, Aug. 1.

REVIEW OF RECENT LITERATURE

52/827
DAVIS, W. B.—Physiological investigation of black heart of potato tuber.—*Bot. Gaz.*, 81 (1926), No. 3, pp. 323-338, figs. 7.

The nature of the physiological changes which must precede or accompany the profound changes taking place in the interior region of the potato tuber, which suffers the breakdown and undergoes the color changes known as black heart, was investigated. The disease was produced in the laboratory at a temperature of 45 degrees C., in a carbon dioxide free atmosphere in which abundant oxygen was available. The ratio of carbon dioxide to oxygen in the intercellular spaces, conductivity of the tissues, catalase activity, and H-ion concentration changes were studied on the affected tissues over a period of about 16 hours.

During the time preceding the incidence of black heart, carbon dioxide accumulates rapidly in the internal atmosphere and oxygen is rapidly depleted, until the intercellular gases contain more than 50 per cent of carbon dioxide and less than 4 per cent of oxygen. This change in the internal environment of the cells is the first change detected, and is followed by increasing permeability of the protoplasm, together with the other changes involved in the development of black heart. At the temperatures used, black heart is apparently the result of high respiratory activity and the failure of the gas exchange to keep pace with respiration rate, but the possible effects of temperature and other factors must not be overlooked.

By following the progress of injury to the protoplasm by electrical conductivity methods it was shown that there is first a rise of resistance in the tissues, extending over a period which varies with the individual tuber at 45 degrees C. This increased resistance is followed by a continuous fall, beginning with the death of the tissues. These changes are more pronounced with the inner tissues of the potatoes. The cortical regions of the tubers show less change in resistance, and are also much slower to become affected with black heart.

The catalase activity of the affected tissues does not seem to be correlated with respiratory activity. During the development of black heart a slight increase of H-ion concentration takes place, but this change is not localized. Temperature may exert a direct effect above 38 degrees C. Color changes similar to or identical with those produced in black heart may be induced in various ways. Probably anything which causes the death of the tissues without

destruction of the enzyme involved, or alteration of the nature of its substrate, may cause the same changes of color in the tissues killed.—H. M. Steece.

GRATZ, L. O.—Irish potato disease investigations, 1924-25 (A preliminary report).—*Florida Agr. Exp. Sta. Bul.* 176. 23 p. *illus.* Nov. 1925.

Alternaria has been isolated from tubers shipped to Florida from Maine, New Jersey, New York, Wisconsin and from Florida grown tubers. Early Rose, Irish Cobbler, Green Mountain, Smooth Rural, and Spaulding Rose have been found affected; the last is apparently most susceptible. Fifty per cent of the tubers examined in a number of Aroostook County warehouses in December 1924 were affected, but few spots were found per tuber and these were one-eighth inch or less in diameter. Increase in size of spots in transit to Florida was considerable in October shipments, much less in lots shipped in December. *Alternaria* may destroy eyes or pave the way for dry rot organisms. Field observations suggest that tuber rot may serve as a center for early blight epidemics on potato foliage.

A troublesome seed-piece rot is caused by a *Fusarium* apparently common in Florida soils. Seed treatment, spraying, strain, source, and variety tests are reported.—Philip Brierley.

GRATZ, DR. L. O.—More potatoes or more acres—Which?—*The Florida Grower* 33 No. 14 p. 8, 9, 19. April, 1926.

A comparison is first made of the relative rank of the United States as regards the World's production of potatoes, then of the state itself as compared with other states in this country, and finally, its relative rank among the early truck crop producing states. In the last mentioned comparison it is claimed that only three states, Virginia and the two Carolinas exceed Florida in the production of early potatoes. It is claimed that approximately 775,000 barrels of the 1925 crop was shipped out of the state. The potato areas of the state are given. The average per acre yield is estimated at from 40 to 50 barrels. Dates of planting, and varieties grown are mentioned. The value of good seed and the use of a good sized set are emphasized as important factors in the production of large yields. Florida growers use a ton of commercial fertilizer per acre. The favorite formula used contains 5 per cent ammonia, 8 per cent phosphoric acid and 5 per cent of potash. A 6-8-5 formula is also a favorite. The usual method is to apply the fertilizer with a 3-row distribution and then work it into the soil. This is done 2-3 weeks before planting. Approximately five sacks of seed are planted per acre. Cultural practices are described in more or less detail. A good grower is described as a man who is totally unfamiliar with slipshod methods. His drainage ditches are always kept clean and his duster is operating early and late at weekly or ten day intervals. No greater acreage is planted by him than can be properly handled. More potatoes per acre rather

than more acres of potatoes is regarded by the author as necessary to success.—W. Stuart.

LACEY, MARGARET S.—Studies in bacteriosis XIII. A soft rot of potato tubers due to *Bacillus carotovorus* and a comparison of the cultural, pathological and serological behavior of various organism causing soft rots.—*Ann. Appl. Biol.* 13: 1-11. F. 1926. No. 1.

B. carotovorus was isolated from a potato tuber from a lot with about 10 per cent soft rot. "This potato showed an extensive soft white rot of the tissue inside the vascular ring while the outer tissue was not affected, so that on external examination the potato appeared sound. There was no blackening of the tissue as is usual in tubers attacked by *B. phytophthorus* and the rot was entirely without smell". A pure culture recovered after some difficulty from the mixed infection reproduced this type of rot; the "tissue inside the vascular ring was quickly reduced to a pulp while the outer tissue either remained sound or was slowly attacked later."

This strain was compared with two other strains of *B. carotovorus* and with strains of *B. solanisaprus* and *B. phytophthorus* in respect to cultural characteristics, acidity changes in carbohydrate broths, pathological characters, and serum agglutination reactions. Pathogenicity tests of the various strains on potato slices, carrot slices, *Vicia faba* plants and turnip roots are reported in detail.

"From these inoculations it is evident that the rot caused by *B. phytophthorus* can always be distinguished from the others by the strong black color produced round the rotted tissue. Also while *B. phytophthorus* can easily attack the outer layers of tubers or roots, *B. carotovorus* species quickly destroy the pith, but only slowly attack the cortical tissue. "The rot produced by *B. solanisaprus* is more watery than *carotovorus* and usually somewhat brownish in color, whereas *B. carotovorus* rots are quite white."

"Conclusion. Cultural, pathological and serological tests all show that a close relationship exists between the three species *B. carotovorus*, *B. solanisaprus*, and *B. phytophthorus*, but there are nevertheless sufficiently marked and constant differences to warrant their continued separation into different species"—Philip Brierley.

LOHNIG, M. P.—(An investigation on the relation between the weather conditions and the occurrence of potato blight (*Phytophthora infestans*); and on the qualities that determine the degree of susceptibility of the tubers for the disease).—*Schweringen* 1924, 129 p. 11 plates. *English Summary* p. 111-129.

Prompted by the discovery in Hungary of a correlation between amount of rainfall and moment of outbreak of Plasmopara on grapes the author sought to find a critical meteorological factor which could be used as a warning of a coming outbreak of potato blight. Thirty exact observations on the date of first appearance of blight were made in different places and extending over five years. Attempts to correlate these dates with some characteristic reading of

such factors as rainfall, vapor pressure, relative humidity or temperature, were unsuccessful. No characteristic weather condition was found correlated with periods of very rapid progress of the disease, nor was the lapse of time between its first appearance and total death of the foliage related to recognizable peculiarities in the factors examined.

Two years field tests with Bordeaux spray indicate that the most effective time for a single application is at the very beginning or before the outbreak of blight. A second application was always of value. Spraying the soil while the plants were very small to check development of *Phytophthora* from possible soil hibernation was without effect. "Good results may be expected from spraying when *Phytophthora infestans* appears early in summer and spreads quickly. When the disease appears late in the season much less is to be expected from spraying. It is possible that refraining from spraying under such circumstances is even safer in the case of varieties with very susceptible tubers; for in this way the foliage is killed off rapidly, and the risk of tuber infection exists for a short time only."

When the same variety was grown on sandy and on clay soils no difference in foliage infections was detected, but the percentage of diseased tubers was higher on clay soil in 13 out of 18 lots. Neither the character of the parenchyma nor the thickness of the skin had any apparent effect on tuber resistance. Soil character did not influence skin thickness. Some varieties, such as Rhode Star, Bravo, and descendants of these two, were resistant to infection when the skin was removed from the unripe tuber and the exposed cork cambium inoculated. This quality is apparently heritable and offers a promising lead for development of a variety with resistant tubers which can be grown on heavy soils. A second factor in tuber resistance is the degree of suberization of the lenticels. This varied with the variety, with the soil type, and is thought to vary also during the season and from one season to another. The parenchyma of lenticels in clay-grown tubers showed little suberization; in sand-grown potatoes of the same varieties suberization was more complete; spore suspension inoculations produced more lenticel infection in the clay-grown tubers. "In inoculated clay-grown tubers the correlation between size of the non-suberized surface of the lenticels and the amount of lenticel infection is sufficiently clear for the condition of the lenticels to be regarded as the cause of a difference in the degree of varietal resistance." Such a correlation was not evident in the sand-grown potatoes. The amount of blight infection through the eyes varied with the variety but did not vary with sand and clay soil. The number of infections through the eyes appeared to increase with the ripening of the tubers. The three factors of tuber resistance discussed, namely resistance of the cork cambium, of the lenticels, and of the eyes, together with the foliage reaction, are compared with field observations on amount of infection in a number of varie-

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ties. Resistance in the cork cambium is considered more effective than lenticel or eye resistance in protecting tubers against blight under unfavorable field conditions. Field resistance in several varieties was not explained by any of the factors investigated.

Resistance in the cork cambium is not due to any anatomical peculiarity, to tannin content or to rate of wound-cork formation. Treatment of a tuber with resistant cork cambium with vapor of ethyl alcohol for 24 hours was found to have a narcotic effect, after which the tuber was invaded by *Phytophthora* to the same extent as a normally susceptible variety. It is concluded from this result that resistance of the cork cambium is not due to any chemical constituent which is always present in the cells.

Anatomical studies showed the path of entry of *Phytophthora* into the eyes is through the outer bud scale which has stomata and other openings in the protective cork layer. The inner bud scale was occasionally invaded but entrance through the growing point was not observed.

Phytophthora remained infectious for at least 14 days in sandy soil and for 30 days in clay soil; the limit of persistence was not determined. The risk of infection of tubers dug at intervals from the field was variable, but more infection took place in lots dug after 4 day periods of comparatively high rainfall. Cut surfaces could be infected after six days healing in the field. Sound tubers newly dug from clay soil were found infected by contact with cut diseased tubers under moist conditions. Sand-grown tubers did

not become infected under like conditions, and neither sand-grown nor clay-grown tubers became infected from cut diseased potatoes when stored under dry conditions. Inoculation of cut leaves was not reliable as a method of determining degree of foliage susceptibility. No correlation was found between behavior of stomata a short time before outbreak of blight and resistance of foliage of the same variety in the field. (From English summary).—**Philip Brierley.**

MURPHY, P. A. AND R. MCKAY.—The development of blight in potatoes subsequent to digging.—*Jour. Dept. Lands & Agr. Ireland* 24: 103-116 Ag. 1924. No. 2.

Tests of the effect of certain digging practices on the development of blight in pitted tubers were carried out in 3 successive years. The crop was sorted at digging and only apparently sound tubers placed in the pits. Pits were opened in midwinter and blight percentage noted. Significantly greater amounts of infection were found in a series dug at intervals with blighted tops undisturbed than in a second series dug at intervals after removal of tops; the percentage infection varied as the digging date had fallen within a period of blight activity in the field or not. When tubers were covered in the pit with blighted stalks, even temporarily, the highest percentages of blight rot resulted. On the other hand 50 marked blighted tubers placed in the pit with the apparently sound crop did not increase the percentage of blight in the latter during the storage interval. The authors conclude that blight does not spread from tuber to tuber in pit storage; that tubers which develop blight in storage were infected or bore the inoculum on their surface when stored; digging the crop when the vines are blighted and before they are entirely dead is practically sure to lead to blight in storage; potatoes dug a sufficient interval after the death of the stalks may be relied on to remain free from blight in storage; removal of the vines some time before digging, from 12 to 30 days under experimental conditions, ensures absence of blight in storage. In a single year's test it was found that practically 75 per cent of the blight rot that occurred in storage appeared within 15 days after digging, and practically all within 32 days.

The authors point out that when blighted but still living vines are removed but the tubers left in place, these continue to become infected for a certain length of time which varies with the season. After this variable interval (12 to 39 days) infections decrease to a negligible amount or even cease entirely. "This strongly suggests that the fungus actually dies out of the soil after a period of apparently independent existence but one of strictly limited duration." In this connection is cited the senior author's work in which *Phytophthora* was shown to remain alive and infective in unsterilized soil and water for a limited time only, namely 44 days. The authors find no evidence that the blight fungus is capable of living indefinitely or hibernating in the soil under natural conditions.—**Philip Brierley.**



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MURPHY, P. A., AND R. MCKAY.—Further experiments on the sources and development of blight infection in potato tubers. —*Jour. Dept. Lands & Agr. Ireland* 25: 10-21. *My* 1925. No. 1.

Practically blight-free tubers for use in these tests in 1924, a year in which a severe epidemic set in early in July and destroyed nearly all the foliage by the end of August, were obtained from plots from which the tops had been removed some time before digging. Only two tubers of a 150 lb. lot of such stock which was pitted at once developed blight in storage. A similar lot spread over the surface of a blighted field of a different color while the blighted vines were still undisturbed, and picked up after 3½ hours, showed blight in 35 tubers. In a third lot left on the blighted plot while it was dug and sorted out again after the operation 153 tubers developed blight in storage. In a fourth lot buried for eight days in the rows from which the blighted crop was removed the disease developed in 20 tubers. It is concluded that sound tubers may become contaminated by contact with infested soil alone or from affected foliage, and may develop blight in storage from the germs of disease which they carry on their surfaces into storage; it is the actual operation of digging, however, which provides the greatest amount of contamination.

The infectiousness of heavily contaminated soil which was stored in large pots out of doors at a distance from its source was found to decline rapidly and disappear completely at the end of the third

week. To test the possibility that the inactivity of the blight organism in the soil after this interval was due to a change to resting condition rather than to dying out, the soil was tested again at the end of the winter which was very mild but wet. No infection was obtained.

Soil tested at once after removal from the field at different depths was found infectious in the upper two inches only. It is suggested that this single test may not be a fair index of the depth of penetration of *Phytophthora* in looser soils and that greater depths may be reached along the stalks.

Wounded and unwounded tubers inoculated with a spore suspension of *Phytophthora* developed 69 and 24 per cent of blight, respectively, in pit storage. When potatoes were cut and allowed to heal for various intervals before placing in contact with contaminated soil infection was obtained up to four days after cutting in one test; in a second test only freshly cut surfaces became infected. Observation of a lot of naturally infected tubers showed that 58 per cent of the blight had entered through wounds.

An attempt was made to determine the time which elapses between contact with infectious material and appearance of blight in tubers. Two lots of sound potatoes were brought in contact with blighted vines, then stored (1) in a furrow in clean soil, and (2) in a sprouting box in a cool storage room. The first blight appeared after about 5 days, under both conditions, two-thirds was evident within 8 days, and practically all infections had appeared by the 22nd day in the soil and by the 19th day in storage. The longer intervals are thought to represent delayed infection rather than a true incubation period. When tubers from a blighted field bearing incipient natural infection were stored in boxes and in a pit, practically all the blight rot which developed was recognizable after 21 days in the boxes and after 28 days in the pit.

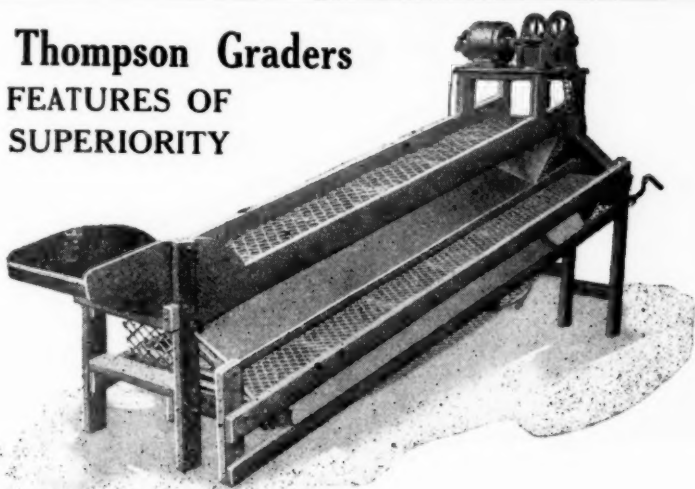
Additional evidence is given that late blight rot does not spread from tuber to tuber in storage and that a soft rot of unknown cause in which bacterial action predominates does spread in storage. The soft rot was found starting from lenticels and wounds in the fall, as "a black, softish rot", mainly superficial at that time. There is no causative connection between the two diseases but blight appears to pave the way for soft rot in pit storage. "It is possible that blighted tubers provide a breeding-ground on which weakly parasitic organisms increase to such an extent in number and virulence as to enable them to invade healthy tubers."—Philip Brierley.

STEECE, H. M.—Breeding work with field crops at the experiment stations.—*U. S. Dept. Agr., Off. Expt. Stas., Work and Expend. Agr. Expt. Stas., 1924, pp. 43-59.*

This review calls attention to some of the inheritance studies carried on at the several State experiment stations with the principal field crops, investigations concerned with the relation of the mode of reproduction to crop breeding, cytological studies, and the results of selection work and of breeding for special adaptations,

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such as resistance to drought, cold, lodging, insects, and diseases. Among the promising lines suggested for further research are investigations of earliness, yield, special adaptations, and cytological studies. The investigations involving potatoes were genetic and correlation studies and selection experiments.—H. M. Steece.

VAN EVERDINGEN, E.—(The relation between the weather conditions and the occurrence of potato blight (*Phytophthora infestans*).—*Tijdschr. Plantens.* 32: 129-140 My 1926. No. 5.

The author briefly discusses the negative result of an investigation by Miss Dr. M. P. Lohnis on the relation between weather conditions and the occurrence of Potato blight (*Phytophthora infestans*) and points out, that too little attention was paid to the combined influence of several weather conditions at a time. Starting from a remark by Roussakov he has added to the data used by Miss Lohnis the occurrence of dew during the night, concluded from dewpoint and minimum temperature and has been led to select days on which the following four conditions are fulfilled:

1. Dew occurred during at least 4 night hours;
2. Minimum temperature above 10 degrees C.;
3. Mean cloudiness of the next day above 0.8;
4. Measurable rainfall during next 24 hours.

Among the 30 dates of outbreak of blight during the years 1919-1923, collected by Miss Lohnis, 29 were preceded within 15 days by a day fulfilling 4 conditions, whereas after May 1, only 5 such days occurred not followed by the outbreak of blight within 15 days.—Author's English Summary.

WERNER, H. O.—The spindle-tuber disease as a factor in seed potato production.—*Nebraska Agr. Exp. Sta. Res. Bull.* 32. 128 p., 34 fig. 1926.

Part of this bulletin deals with the various practical phases of the spindle-tuber problem as it exists in Nebraska, and part is devoted to a study of the means and rate of spread of the disease, the effect of environmental conditions, and a test of various means of control. Spindle-tuber is found to be responsible for much of the deterioration of potato stocks in Nebraska that was formerly attributed to unfavorable environment. It is prevalent throughout the state, but spreads more rapidly in the irrigated than in the dry-land sections. It is largely responsible for the poor yields obtained in the irrigated sections of western Nebraska and is the most common cause of rejection for certification. Not only the yield but the market quality, in respect to roughness and poor shape, are impaired. Dry-land culture reduces the rate of spread but not the amount of the disease. Mulching with straw resulted in a crop with less disease and milder symptoms than was obtained from unmulched plants.—Spindle-tuber affects all the varieties tested, including representatives of 10 groups, and no instance of resistance was discovered. Different varieties show various degrees of abnormality, but in general the tubers are elongated, cylindrical, and tend to be smaller than normal tubers. The intensity of color and russetting is reduced in varieties normally with these characters. The lenticels tend to be more prominent than in healthy tubers. Plant growth is retarded, and spindle-tuber plants are not only slower to emerge, but remain smaller than normal ones. Infection may spread within the first 10 days the plants are up, but aside from transmission by tuber grafts, the means of spread is not fully demonstrated. Aphids are not at all common in western Nebraska.—Tuber line selection was without avail when spindle-tuber existed in a strain, and seed selection of the best type tubers was useless. Isolation of the seed plot, and early, thorough, and repeated roguing are proving effective in combating the disease as shown by a decrease in the per cent of spindle-tuber in stocks accepted for certification in Nebraska.—F. Weiss.

REVIEW.—“Report on the Marketing of Potatoes in England and Wales.”—*Economic Series No. 9. Ministry of Agriculture and Fisheries, London.*

Although the landing of European potatoes in U. S. A. is prohibited, the above report can hardly fail to interest those engaged in the potato industry of this country. The potato crop is the most important raised on British farms and exceeds the cereal crop in

value of output. The report enumerates in the first instance the sources of supply: in Great Britain potatoes may be regarded as derived from the following sources, viz., farms 80 per cent, allotments and gardens 15 per cent, and imports 5 per cent; the location of supplies is defined in detail. In the second place the existing trade conditions and marketing organizations are fully and accurately described, both as regards ware and seed potatoes. But this does not exhaust the work by any means: criticisms of many present practices are offered in a helpful spirit and many constructive suggestions for the bettering of marketing practices are given.

Much of the data is presented in tabular and pictorial form and the booklet is very readable.

Note: To be had at any of H. M. Stationery Offices, e. g. Adastral House, Kingsway, London, W. C. 2 or 28, Abingdon St., London, S. W. 1. (Price 1/9, post free).

—T. McIntosh.

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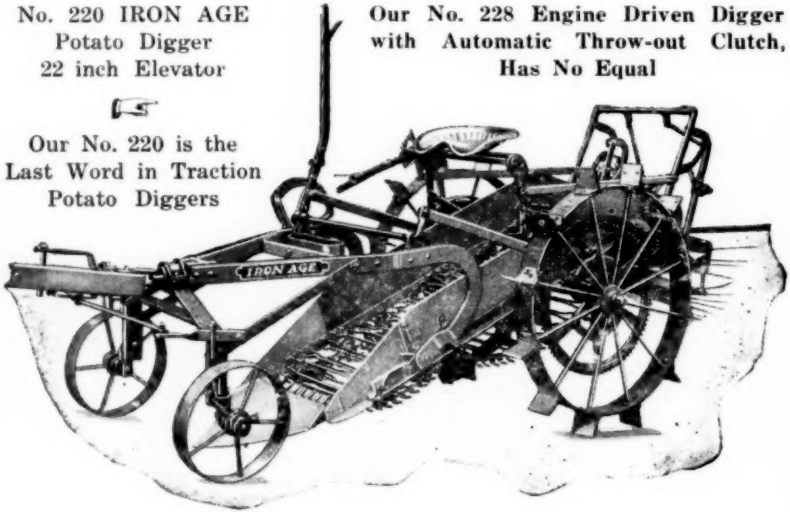
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